

What is claimed is:

- 1 1. A method for controlling blade tip clearances comprising the steps of:
 - 2 (a) operating a turbine engine, the turbine engine having a compressor
 - 3 section, a combustor section and a turbine section, the turbine section including a
 - 4 rotor with discs on which a plurality of blades are attached;
 - 5 (b) extracting a portion of the combustion gases from the combustor
 - 6 section of the turbine engine;
 - 7 (c) combining the portion of combustion gases with a portion of the
 - 8 compressor exit air to form a mixture, wherein the temperature of the mixture is
 - 9 greater than the temperature of the compressor exit air as it exits the compressor
 - 10 section; and
 - 11 (d) supplying the mixture to at least one stationary blade ring, wherein at
 - 12 least a portion of the at least one blade ring is substantially proximate to the blades,
 - 13 wherein the temperature of the mixture is greater than the temperature of the at least
 - 14 one blade ring,
 - 15 whereby exposure to the mixture causes thermal expansion of the blade ring
 - 16 such that the clearance between the tips of the blades and a neighboring stationary
 - 17 blade ring increases.
- 1 2. The method of claim 1 wherein the combustor section includes a transition for
- 2 ducting combustion gases from the combustor section to the turbine section, wherein
- 3 the portion of combustion gases are extracted from the transition.
- 1 3. The method of claim 1 wherein the turbine include at least two rows of blades,
- 2 wherein a first row of blades is located upstream of a second row of blades, the first
- 3 row of blades being substantially proximate to a first blade ring and the second row
- 4 of blades being substantially proximate to a second blade ring.
- 1 4. The method of claim 3 wherein the mixture is only supplied to the first blade
- 2 ring.
- 1 5. The method of claim 3 further comprising the step of:

2 (e) discharging the mixture from the at least one stationary blade ring into
3 the turbine flow downstream of the first row of blades.

1 6. The method of claim 1 wherein steps (b)-(d) occur during part load operation
2 of the engine.

1 7. The method of claim 1 wherein steps (b)-(d) occur during engine start up until
2 the engine reaches from about 10% load to about 25% load.

1 8. The method of claim 1 further comprising the step of:

2 (f) substantially ceasing steps (b)-(d) when the engine reaches
3 substantially steady state conditions and supplying only compressor exit air to the at
4 least one blade ring.

1 9. The method of claim 8 wherein substantially steady state conditions include
2 base load operation.

1 10. A turbine system comprising

2 a turbine engine having a compressor section, a combustor section, and a
3 turbine section, the turbine section including a plurality of discs mounted to a rotor,
4 wherein a plurality of blades are attached to the discs and a stationary blade ring
5 surrounds at least a portion of the blades; and

6 a channel extending from the combustor to the blade ring, wherein the
7 channel permits flow of a portion of combustion gases out of the combustor section,
8 the channel further including an inlet for permitting entry of a portion of compressor
9 exit air such that the compressor exit air can mix with the combustion gases in the
10 channel so as to cool the combustion gases,

11 whereby the clearance between the tips of the blades and the surrounding
12 stationary blade ring increases upon exposure to the mixture of combustion gases
13 and compressor exit air.

1 11. The turbine system of claim 10 further including a valve for regulating the flow
2 of combustion gases into the channel.

1 12. The turbine system of claim 11 wherein the valve substantially restricts flow of
2 combustion gases through the channel when the engine reaches substantially
3 steady state operation.

1 13. The system of claim 12 wherein substantially steady state operation includes
2 at least base load operation.

1 14. The turbine system of claim 10 wherein the blade ring includes an outlet for
2 discharging the mixture of combustion gases and compressor exit air downstream of
3 the first row of blades and into the turbine gas flow.